REMARKS

Status of case

Claims 1 through 20 are pending.

Claim Rejections under 35 U.S.C. § 101

Claims 6 and 12 were rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. Applicants amend claims 6 and 12 as believed appropriate.

Claim Rejections under 35 USC §103

Claims 1, 2, 6-8, and 12-20 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,272,177 (Murakami) in view of U.S. Patent No. 7,227,901 (Joch). Claims 3, 5, 9, and 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami in view of Joch and further in view of U.S. Patent Application No. 2002/0146072 (Sun). Claims 4 and 10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami in view of Joch and further in view of Shen et al., "Adaptive Motion Vector Resampling for Compressed Video Down Scaling," IEEE 1997.

Applicants previously argued that the Murakami and Joch references do not teach interpolation. In response, the Office states:

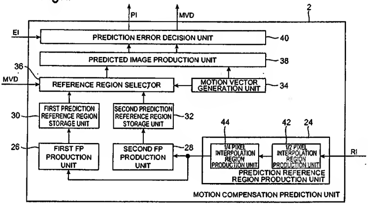
> As understood by the Examiner interpolation is the estimation of a value using known information as evidenced in Joch – col. 5 lines 39-67; col. 6 lines 1-7; col. 12 lines 4-35; col. 11 lines 25-29.

Applicants respectfully contend that the definition of interpolation as an "estimation of a value using known information" is incorrect. Interpolation is to estimate a value **between** two values. For example, claim 1 recites "generating a prediction reference image that are formed by providing interpolated pixels which are **produced by interpolation between integer pixels of a reference frame** in a predetermined region of the reference frame". Emphasis added; see also claims 2, 6-8, and 12. The application as filed provides many examples of the interpolation, such as "by disposing interpolated pixels at the 1/2 pixel positions or 1/4 pixel positions between the integer pixels of the reference frame". See paragraph [0005]. Therefore, the Office's definition of interpolation does not comport with proper interpretation of the term.

2. Lack of combination of "extracting complexity information using inter-block analysis" and "generating a prediction reference image" using "intra-block" interpolation

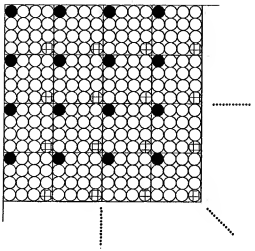
In one aspect, the present application is directed to extracting complexity information using "inter-block analysis" and using that complexity information to generate the prediction reference image using "intra-block" interpolation. See claims 1, 2, 6-8, and 12. Specifically, the present application provides examples of extracting complexity information using inter-block analysis, such as determining the differential motion vectors in blocks surrounding the processing target block. The analyzed inter-block complexity may be used in order to determine the number of filtering pixels for intra-block interpolation. An example of this is in the present application is motion compensation prediction unit 2, illustrated in Figure 2 (reproduced below):

Fig.2



Motion compensation prediction unit 2 includes intra-block interpolation, including first FP production unit 26 and second FP production unit 28. Figure 3 (reproduced below with associated text) is an example of the first prediction reference image generated by the first FP production unit 26:

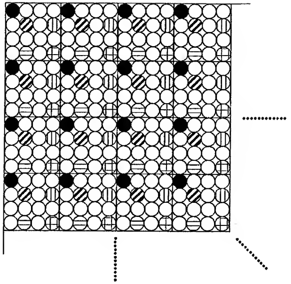
Fig.3



[0069] FIG. 3 is a schematic view of an example of a first prediction reference image generated by a first FP production unit provided in the video encoding apparatus of the first embodiment. The circles in FIG. 3 indicate pixels. In FIG. 3, the solid black circles indicate integer pixels, and the empty circles indicate interpolated pixels. Furthermore, the circles with lattice-form hatching indicate the FPs. **The first FP production unit 26 provides a pixel value determined by adding values which are calculated by multiplying each of the pixel values of four neighborhood integer pixels which are located directly under the FP [funny position] and lined up in the horizontal direction by a coefficient of 1/2 to each of the FPs.** [Emphasis added]

Figure 4 (reproduced below with associated text) is an example of the first prediction reference image generated by the second FP production unit 28:

Fig.4



[0070] The second FP production unit 28 produces a second prediction reference image which is provided with a greater number of FPs than in the case of the first FP production unit. The second FP production unit 28 stores the second prediction reference image in the second prediction reference region storage unit 32. FIG. 4 is a schematic view of an example of a second prediction reference image produced by a second FP production unit provided in the video encoding apparatus of the first embodiment. In FIG. 4 as in FIG. 3, circles indicate pixels. In FIG. 4, the solid black circles indicate integer pixels, the empty circles indicate interpolated pixels, and the circles shown with hatching indicate FPs.

[0071] The second FP production unit 28 gives pixel values produced as described below to the FPs. **A pixel value obtained by applying an one-dimensional low-pass filter with coefficients of (4/32, 24/32, 4/32) to three neighborhood integer pixels which are lined up in the horizontal and located in direction immediately above the FP is given to each of the FP at the (1/4, 1/4) pixel positions shown with diagonal hatching in FIG. 4.** A pixel value obtained by applying an one-dimensional low-pass filter with coefficients of (-2/32, 1/32, 17/32, 17/32, 1/32, -2/32) to six neighborhood integer pixels which are lined up in the horizontal direction and located immediately above the FP is given to each of the FPs at the (3/4, 1/4) pixel positions shown with vertical hatching. A pixel values obtained by applying an one-dimensional low-pass filter with coefficients of (2/32, 6/32, 8/32, 8/32, 2/32) to five neighborhood integer pixels which are lined up in the horizontal direction and located immediately below the FP is given to each of the FPs at the (1/4, 3/4) pixel positions shown with horizontal hatching. A pixel values obtained by applying an one-dimensional low-pass filter with coefficients of (3/32, 13/32, 13/32, 3/32) to four neighborhood integer pixels which are lined up in the horizontal direction and located immediately below the FP is given to each of the FPs in the (3/4, 3/4) pixel positions shown with lattice-form hatching. [Emphasis added]

The cited references fail to teach the limitations as claimed. The Joch reference is clear in its focus on inter-block filtering. Specifically, the Joch reference teaches that the edge of the block is compared with an adjacent block to determine the "smoothness." If the edge of the block is not smooth, the filtering step is for the express purpose of "reduc[ing] blocking artifacts that are introduced by the coding process." Col. 12, lines 5-7. In order to do this, a 3-tap filter (instead of a 5-tap filter) is used. The 3-tap filter has fewer filter coefficients than the 5-tap filter, and therefore has a more gradual rolloff than a 5-tap filter (more effectively "smoothing" the boundary between the blocks. Further, the Joch reference does not teach or even suggest any sort of complexity analysis as claimed. Instead, the Office Action relies on the Murakami reference for that teaching. However, the complexity analysis in the Murakami reference is not used for any sort of <u>intra-block</u> purpose, as in the claims as currently presented. Therefore, for at least the above-reasons, independent claims 1, 2, 6-8, and 12 are patentable over the cited art.

Claims 14 and 16

The Office Action states the following in rejecting claims 14 and 16:

> As to claim 14, Murakami modified by Joch teaches the integer pixels comprises original pixels; wherein the predicted image comprises original pixels and interpolated pixels; and wherein none of the original pixels are filtered.
>
> As to claim 16, see the discussion of claim 14 above.

The above rejection does not establish a prima facie case for rejecting the claims. No citation at all is provided. Moreover, neither the Joch reference nor the Murakami reference teaches the limitations as claimed, such as that none of the original pixels are filtered. Rather, both of the references teach that at least some of the original pixels undergo some sort of filtering.

Claims 17-20

The Office Action states the following in rejecting claims 17-20:

> Murakami modified by Joch teaches . . . wherein none of the original pixels are filtered. [Jock – fig. 5; fig. 3a; col. 13 lines 20-50; not all pixels of the macroblock are filtered only those on the boundary]

The Office Action's own reasoning shows that the Joch reference fails to teach the cited limitation. The limitation states that "**<u>none</u>** of the original pixels are filtered." However, under the Office Action's reasoning, the Joch reference teaches that some of the original pixels (those on the boundary) are filtered. Therefore, the Joch reference, even as interpreted in the Office

Action, does not teach that "none" of the original pixels are filtered. For at least this reason, claims 17-20 are patentable over the cited art.

SUMMARY

Applicant respectfully requests early allowance of this application. The Examiner is invited to contact the undersigned attorneys for the Applicant via telephone if such communication would expedite this application.

Respectfully submitted,

Amir N. Penn
Registration No. 40,767
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200